PDnet™

# PAD-250MAe-PN User Manual

IPEX
automation technologies GmbH

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CE

The controller PAD-250MAe-PN fulfills the demands of the EU-directive 89/336/EWG „Elektromagnetische Verträglichkeit“(electromagnetic compatibility). The conformity of the controller PAD-250MAe-PN with the above mentioned directive is confirmed by the CE-Sign.




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# 1 Preface

This manual shall assist you with the installation, the configuration and the operation of **PAD-250MAe-PN**.

APEX automation technologies GmbH may do modifications of specifications and further developments at any time without notification.This may lead to deviations from this manual.

Hardware will be supplied by APEX automation technologies GmbH together with a PDnetIP-CD, which contains software and documentation necessary for the operation of PAD-250MAe-PN.

Please always use software and documentation of a PDnetIP-CD as a unit.

The current PDnetIP-CD can be recalled under ftp2.apex.deT. Please use for download user name **kunde** and for password **apex**.

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## 1.1 Product Overview

PAD-250MAe-PN is a PROFINET IO-Device for connection of local peripheral devices on basis of existing DTA-racks. Data transfer is possible with every PROFINET IO-Controller.

## 1.2 Conventional Utilization

The PROFINET IO-Device PAD-250MAe-PN is exclusively determined to:

- connect a DTA 112 or DTA 113 with PROFINET IO-Controller.

If PAD-250MAe-PN is used different as described in the manual, no safe operation will be warranted.

The producer is not responsible for damages, additional expenditures, problems, failures and especially not for all personal- and property damages, which are resulting from unconventional utilization.

For normal operation of PAD-250MAe-PN, following operational restrictions are to be observed:

- The serial interface will not be connected.
- The USB interface will not be connected.
- Cables for current supply must not exceed a length of 30 m.
- PAD-250MAe-PN is not authorized for use in residential area.


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## 1.3 General Advice

The installation of the PDnetIP-Controller should be accomplished by qualified staff. APEX automation technologies GmbH does not take responsibility for any damage due to improper installation.

This user manual explains installation and operation of PAD-250MAe-PN. Information concerning control system respectively programming system are to be taken from the corresponding documentations.

PAD-250MAe-PN should remain in an antistatic-protective bag until its installation.

If PAD-250MAe-PN is removed from the control application it will have to be stored in an antistatic-protective bag.



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## 1.4 Scope of Delivery

Scope of delivery of PAD-250MAe-PN includes:

1. PAD-250MAe-PN in an antistatic-protective bag
2. CD-ROM PDnetIP incl.:
   - this manual
   - GSD-file
   - firmware

## 1.5 Repair

Please observe that, in case of repair, PAD-250MAe-PN will be loaded with active firmware and other setup data within the framework of checking.

Therefore it is important to possess all documentation and tools in order to be able to re-establish the old configuration.


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# 2 Technical Data

| Allocation | |
|---|---|
| Central-unit rack | DTA 112 (4 usable slots)<br>DTA 113 (9 usable slots) |
| Connection | PAB1-interface |
| Supply input | 18 - 36 V / max. 4 A |
| Supply output | 5 V / max. 9 A (at PAB1) |
| **PROFINET-Connections** | |
| Quantity | 2 |
| Transmission rate | 100 Mbit/Second<br>Ethernet 100Base-TX |
| Cable type | Twisted-Pair with RJ-45 connector Cat. 5 |
| **Serial interfaces** | |
| Quantity | 2 |
| Conduction physics | RS-232 |
| Transmission rate | 50 - 115.200 Bit/Seconds (usable baud rates are different in protocols) |
| Connection | 9 pole SubD-Socket |
| **USB** | |
| Quantity | 1 |
| Conduction physics | USB 1.1 |
| Transmission rate | Full speed (12 Mbps) |
| Connection | 5 pole USB-Socket |
| **Processor** | |
| Type | Fujitsu MB96F338USA with 32KB RAM + 544KB FLASH |
| **Mechanical construction** | |
| Cardformat | Double europe card (234 mm x 160 mm) |
| Width | 4 TE |
| Weight | 500 g |
| **Environmental conditions** | |
| Temperature | 0 - 60 °C (in use), -40 - +85 °C (in storage) |
| Air humidityt | 10 % - 80 % (non-condensing) |

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# 2.1 Interfaces

### 2.1.1 PAB1-Bus

PAD-250MAe-PN exchanges data via PAB1-interface with E/A cards in the rack and sends them to the PROFINET IO-controller.

Currently following E/A cards will be supported:

- DAP 102
- DAP 103
- DAP 106
- DAP 112
- DAP 116
- DAP 132
- DEP 112
- ADU 115
- ADU 116
- DAU 104
- DAU 108
- DAU 109

Maximum input and output data possible to transmit are 220 Byte.

Sequence time for actualization of input respectively output data will be, if only digital cards are used, less than 4msec. In case of using analog input cards, sequence time can be approximately calculated as follows:
Sequence time < 4ms + 2ms x number of analog input cards.

A more detailed description concerning influence of analog cards on data sequence time is to be found in attachment.


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### 2.1.2 PROFINET

PAD-250MAe-PN is equipped with two PROFINET-interfaces. By means of the integrated 2-port realtime-switch PAD-250MAe-PN can, accordant to application, be used for star, linear or bus topologies. LLDP and SNMP-routines support the topology recognition and installation diagnostics.

The Mac-Address (Ethernet-Address) of PAD-250MAe-PN is stored in hardware and unchangeable. All delivered PAD-250MAe-PN use a Mac-Address beginning with 00:05:DA.

The following table shows allocation of RJ-45 connection socket, which corresponds to the IEEE802.3 Twisted Pair-interface.

| Pin | Signal |
|---|---|
| 1 | Transmit + |
| 2 | Transmit - |
| 3 | Receive + |
| 6 | Receive - |

### 2.1.3 USB

PAD-250MAe-PN is equipped with an USB-interface version USB 1.1, socket Typ A.

The USB-interface is used for installation of firmware.

The following table shows allocation of USB-socket.

| Pin | Signal |
|---|---|
| 1 | +5 V |
| 2 | Data - |
| 3 | Data + |
| 4 | GND |



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### 2.1.4 Serial Interface

PAD-250MAe-PN is equipped with a 9-pole SubD-socket.

The Firmware uses a serial interface for output of status indication.

The loader uses a serial interface for output of version indication.

Information on applied protocol can be found in chapter 5.1 and 5.3.

The following table shows allocation of serial interface.

| Pin | RS-232, V.24 Signal |
|---|---|
| 1 | - |
| 2 | RxD |
| 3 | TxD |
| 4 | - |
| 5 | GND |
| 6 | - |
| 7 | - |
| 8 | - |
| 9 | Prg-Pin |

- not allocated

The following table shows how a serial cable has to be converted in order to be able to look at status indication on PC with help of a terminal programme.

| PAD-250MAe-PN | PC |
|---|---|
| 2 | 3 |
| 3 | 2 |
| 5 | 5 |

### 2.1.5 Operating Voltage

PAD-250MAe-PN will be supplied with operating voltage via the socket marked with „24 Volt“.

PAD-250MAe-PN may be operated with a feed-in from 18 V up to 36 V, fast fused by 6,3 A.

The trigger level for undervoltage survey is programmed to 20 V. Thus, for normal operation, voltage should exceed this level.


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# 2.2 Software

### 2.2.1 Conformance Class

PAD-250MAe-PN corresponds to conformance class B and supports the following RT-communication classes:

- RT C1 (not-synchronized)
- RT C2 (synchronized/not-synchronized)

### 2.2.2 Performance

PAD-250MAe-PN supports:

- 100 Mbps, full duplex
- Sequence times of 1ms
- Up to 220 Bytes cyclic- IO-data in each direction.

### 2.2.3 Alarm Signals

PAD-250MAe-PN supports:

- Pull/Plug-alarm

### 2.2.4 Ressources

PAD-250MAe-PN supports:

- 9 Slots (a' 1 Subslot) for alltogether 9 IO-cards in DTA-rack
- 1 Diagnostics-module



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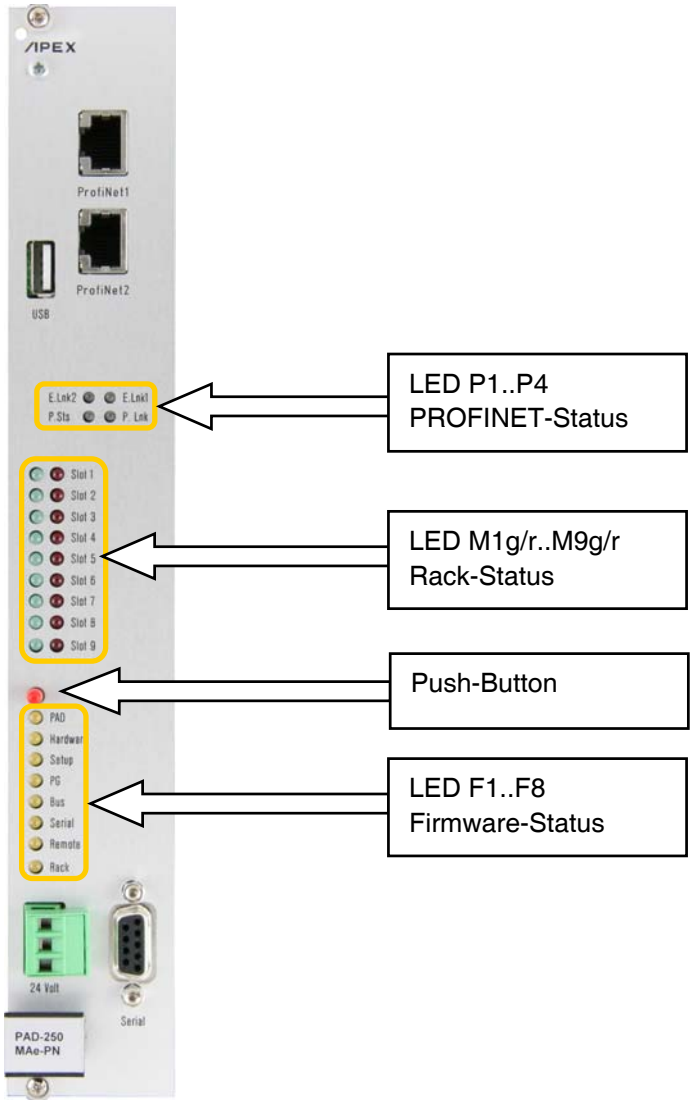
# 3 Indicating and Operating Elements





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## 3.1 Light-Emitting Diodes Groups

For diagnostics without special tools PAD-250MAe-PN has 30 light-emitting diodes (LED) in order to represent the active operating conditions. These LED's are splitted into three groups:

- PPOFINET-Status-LED group: is built up of the upper 4 LED's, arranged in a square.
- Rack-Status-LED group: is built up of 9 green and 9 red LED's, arranged in a double series.
- Firmware-Status-LED group: is built up of 8 yellow LED's below the push-button.

The significance of PPOFINET-Status-LED group as well as Rack-Status-LED group is dependent on condition of the Firmware-Status-LED group. See chapter 3.1.2.

**PROFINET-Status-LED group**

| Identifier | Inscription | Colour | Remark |
|---|---|---|---|
| P1 | E.Lnk2 | Green | Link Channel 2 |
| P2 | E.Lnk1 | Green | Link Channel 1 |
| P3 | P.Sts | Green/Red | Status PROFINET IO-Device Duo-LED |
| P4 | P.Lnk | Green | PROFINET IO-Controller Communication-Status |

**Rack-Status-LED group**

| Identifier | Inscription | Colour | Remark |
|---|---|---|---|
| M1g/r | Slot1 | Green/Red | Double series 2 LED's/Slot |
| M2g/r | Slot2 | Green/Red | |
| M3g/r | Slot3 | Green/Red | |
| M4g/r | Slot4 | Green/Red | |
| M5g/r | Slot5 | Green/Red | |
| M6g/r | Slot6 | Green/Red | |
| M7g/r | Slot7 | Green/Red | |
| M8g/r | Slot8 | Green/Red | |
| M9g/r | Slot9 | Green/Red | |



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**Firmware-Status-LED group**

| Identifier | Inscription | Colour | Remark |
|---|---|---|---|
| F1 | PAD | | |
| F2 | Hardware | | |
| F3 | Setup | | |
| F4 | PG | | Loader/Firmware-display |
| F5 | Bus | | |
| F6 | Serial | | Not supported |
| F7 | Remote | | |
| F8 | Rack | | |

### 3.1.1 PROFINET-Status

The 3 green LED E.Lnk1, E.Lnk2 und P.Lnk, as well as the Duo-LED P.Sts, conduce to the diagnostics of hardware-status of PROFINET-interfaces. Control application of LED will be directly carried out by hardware and is independent from firmware. LED's display active status of PROFINET-interfaces.

Display of PROFINET-Status-LED's is only applied for in normal operation when PAD-250MAe-PN has finished configuration-phase. When this PAD is located in loader PROFINET-Status-LEDs give no information.



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**Diagnostics PROFINET-Status**

| Identifier | Contents | Status | Meaning |
|---|---|---|---|
| P1 | LINK | on | Port1 connection available |
| | | jittering | Port1 data transfer |
| | | off | Port1 no connection |
| P2 | LINK | on | Port2 connection available |
| | | jittering | Port2 data transfer |
| | | off | Port2 no connection |
| P3 | PROFINET-STATUS | green on | PROFINET IO-Device initialized, no error |
| | | green 1x flashing | Diagnostics data |
| | | green 2x flashing | Identification flashing (called up by engineering-tool) |
| | | red 1x flashing | Configuration errror<br>- too many modules/submodules<br>- too many IOs in IO-Controller configuration<br>- IO-Controller-configuration does not comply with existing |
| | | red 3x flashing | No station name or IP-Address |
| | | red 4x flashing | Internal error |
| | | off | Not initialized |
| P4 | PROFINET-Connection | on | Online, RUN<br>- Connection to IO-Controller OK<br>- IO-Controller in RUN-Status |
| | | 1x flashing | Online, STOP<br>- Connection to IO-Controller OK<br>- IO-Controller in STOP-Status |
| | | off | Offline, no connection to IO-Controller |

### 3.1.2 Firmware-Status

The Yellow LEDs conduce to diagnostics of firmware- or loader-status. When push-button is not actuated and the yellow PG-LED (F4) is offline, firmware is running and the following description is to be applied for. When PG-LED runs or flashes, PAD-250MAe-PN is located in loader and description of chaper 3.1.3 is to be applied for.

It can be distinguished between 4 phases when firmware is running:



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#### 3.1.2.1 FW: Boot-Phase

After power-up respectively reset all LEDs of rack-status-group and firmware-status-group flash shortly. During boot-phase hardware will be initialized and tested as well as active implementation of DTA-rack will be find out. The yellow PAD-LED (F1) flashes.

After successful hardware-initialization the yellow PAD-LED (F1) flashes constantly and PAD-250MAe-PN changes into configuration-phase. This determined PAD-configuration will be compared later with the one expected by the PROFINET IO-Controller.

If an error is find out during the boot-phase, the yellow hardware-LED (F2) will start to flash and with help of the red rack-status-LEDs (M1r-M8r) an error code will be displayed (see chapter 6.1). PAD-250MAe-PN rests in this state until next restart.

#### 3.1.2.2 PROFINET-Connection-Establishment-Phase

After successful hardware-initialization PAD-250MAe-PN is in PROFINET-Connection-Establishment-Phase and is waiting or setup-data of PROFINET IO-Controller. This phase will be displayed by flashing of the yellow Bus-LED (F5) and the remote-LED (F7). The PAD- LED (F1) is still running. The yellow Bus-LED wil change to permanent online if another participant is found on one of the two ethernet-channels.

After receipt of setup-data from PROFINET IO-Controller, the yellow, constantly flashing, remote-LED (F7) displays the established connection to PROFINET IO-Controller and PAD-250MAe-PN changes into the setup-phase.

#### 3.1.2.3 Setup-Phase

After successful communication-setup with PROFINET IO-Controller, PAD-250MAe-PN is in setup-phase. In addition to the PAD- LED (F1), the Bus-LED (F5) and Remote-LED (F7) are now constantly running.

PAD-250MAe-PN compares the PAD-configuration expected by the PROFINET IO-Controller with the determined PAD-configuration during the boot-phase. If all PADs expected by PROFINET IO-Controller are available, the yellow Setup-LED (F3) will be switched on constantly at the end of the setup-phase. The yellow Setup-LED will flash if cards are missing or are plugged incorrectly. Thereafter, PAD-250MAe-PN changes into the data-transfer-phase.



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#### 3.1.2.4 Data-Transfer-Phase

After receipt and interpretation of setup-data by PROFINET IO-Controller, PAD-250MAe-PN is in data-transfer-phase. PAD-LED (F1), Bus-LED (F5)- und Remote-LED (F7) are flashing constantly. Corresponding to the configuration comparison during the setup-phase the yellow Setup-LED (F3) flashes or is switched on constantly. Besides the yellow Rack-LED (F8) now displays the state of PADs in DTA-rack.

A permanently flashing Rack-LED means that all PADs are available and run error-free. In contrast a flashing Rack-LED signals missing or defective PADs.

State of the single PADs will be displayed with the help of rack-status-LED-group.

**Diagnostics Firmware-Status**

| ID | Inscription | Status | Meaning |
|---|---|---|---|
| F1 | PAD | on | Normal state, HW-initialization completed |
| | | off | Boot-Phase, HW-Initialization + test wll be effected |
| F2 | Hardware | off | Normal state, no error. |
| | | flashing | Firmware has discoverd a hardware error.<br>Rack-Status-LED-group displays error code (see appendix) |
| F3 | Setup | off | Configuration data of PROFINET IO-Controller not yet received. |
| | | flashing | Received configuration data do not comply with rack interior. |
| | | on | Received configuration data comply with rack interior. |
| F4 | PG | off | Normal operating state. |
| | | on | Loader is running. |
| | | flashing | |
| F5 | Bus | on | At least one ethernet connection available. |
| | | flashing | No Link at ethernet-port available. |
| F6 | Serial | off | Normal state, is currently not being supported |
| F7 | Remote | on | Communication with PROFINET IO-Controller runs error-free. |
| | | flashing | No or defective communication with PROFINET IO-Controller. |
| F8 | Rack | On | Normal state |
| | | flashing | Projected and found PAB1-card do not accord.<br>Or error-flag of PAB1-IO-card marked.<br>Or IO-outlets of a PAB1-card could not be set on proven values. |

* Flashing of Setup-LED cannot be confirmed with the help of push-button.



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## 3 Indicating and Operating Elements
## 3.1 Light-Emitting Diodes Groups

### Causes for error messages

| LED | Possible Cause |
|---|---|
| F2<br>Hardware | M1r..M8r-LED display error code (see appendix)<br>Task: Repair required. |
| F3<br>Setup | Will flash if configuration determined after power-up does not comply with the one expected by PROFINET IO-Controller.<br>Task: Implement PADs according to expected configuration and initialize restart. |
| F5<br>BUS | No link available at Ethernet-Port<br>Task: Check Ethernet-configuration |
| F7<br>Remote | No communication with PROFINET IO-Controller<br>Task: Check device name and IP-address. |
| F8<br>Rack | No or wrong PAD, Error-flag of PAB1-IO-card marked.<br>Task: Substitute defective IO-card . |




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### 3.1.3 Loader-Status

Loader needs for status-display only the yellow PG-LED (F3). All other LED are switched off when loader is active.

**Diagnostics Loader-Status**

| ID | Inscription | Status | Meaning |
|---|---|---|---|
| F4 | PG | off | Firmware runs and corresponding valid table is to be found in chapter 3.1.2 |
| | | on | Loader is in active state and new firmware can be loaded via USB-interface. |
| | | flashing | Loader loads new firmware |

### 3.1.4 Rack-Status

The state of a PAD found in a configured slot will be signalized by the rack-status- LED's M1r/g..M9r/g.

**Diagnostics Rack-Status**

| Greer LED | Red LED | Meaning |
|---|---|---|
| on | off | Slot has been configured. Configured E/A-card is available and operates error-free. |
| on | flashing | E/A-card signalizes an error. No data will be transferrred to the PAD. |
| on | on | Meanwhile, E/A-card signalized an error that is no more existent. Red LED can be confirmed by loader and switches off thereafter. |
| off | flashing | No or wrong E/A card in slot. |
| off | off | Slot not configured. |

*only valid, if PG-Status- and Hardware-LED are offline.

When PAD is defective the yellow rack-status-LED is also flashing.

If an hardware error of PAD-250MAe-PN is recognized during the boot-phase of the firmware, the yellow hardware-LED and the M1r..M8r-LED will display an error code (see appendix).



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## 3.2 Push-Button

The push-button has different functions which are being activated depending on activity time of push-button and active operation type:

- Confirm error → see chapter 3.2.1
- Activate loader → see chapter 3.2.2.1
- Quit loader → see chapter 3.2.2.2
- Initiate restart → see chapter 3.2.3
- Delete PROFINET-Address via Factory-Reset → see chapter 3.2.4

### 3.2.1 Error confirmation

Pushing of push-button (at most 1 second) causes deletion of internal error markers of firmware. Associated with this action the yellow rack-LED (F8) changes from flashing to constant light and the LED M1r..M8r switch off. Is the cause of error still existent, the LED related to this error cause begins to flash again after some time.

This flashing of the setup-LED (F3) cannot be resetted by pushing of push-button. The yellow setup-LED will only flash constantly if the PAD-configuration determined after a restart complies with the one expected by the PROFINET IO-Controller.

A flashing hardware-LED can only be deleted by means of a restart.

Bus-LED (F5) and remote-LED (F7) always display the active status. Error markers will not be set. Flashing of this LED changes to constant light when error cause is no more existent.

### 3.2.2 Loader

Depending on the aim to activate or quit the loader, it has to be recognized before if loader or firmware is running. Differentiation is possible with the help of PG-LED (F4). Firmware is running when push-button is not being pushed and the PG-LED is offline. PAD-250MAe-PN is in the loader when LED is running or flashing.


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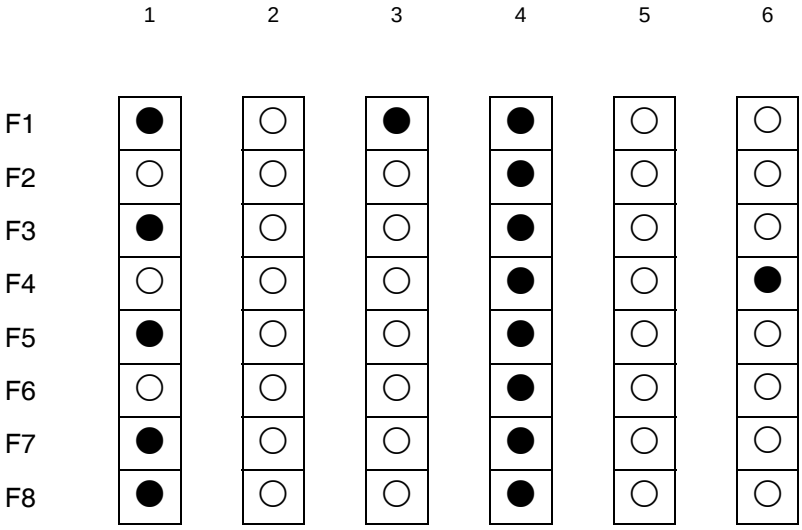
#### 3.2.2.1 Activate

The following table shows how to activate the loader when firmware is running. The image of the yellow LED F1 up to F8 is marked in each column.




| Column | Meaning |
|---|---|
| 1 | Firmware is running and no errors are existent. |
| 2 | Push-button has been pushed and all LED switch-off. |
| 3 | Every second further LED switch-off. |
| 4 | After 8 seconds all LED are.switched-on. If push-button is being unhanded now, firmware will receive information to start loader. |
| 5 | All LED switch-off. |
| 6 | PAD-250MAe-PN initiates restart and is plugged in loader what is recognizable by flashing PG-LED (F4). |



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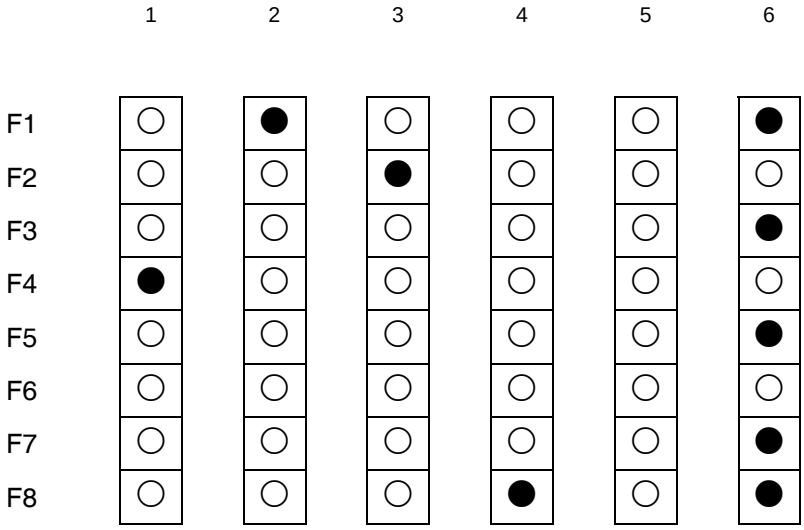
#### 3.2.2.2 Quit

The following table shows how an activated loader can be quit again. The image of the yellow LED F1 up to F8 is marked in each column.




| Column | Meaning |
|---|---|
| 1 | Loader is running. |
| 2 | Push-button has been pushed and LED F1 up to F8 switch-off. |
| 3 | In about a second timing the LED light walks down. |
| 4 | All yellow LED F1 up to F8 walked through. |
| 5 | When the last yellow LED F8 switches-off, PAD-250MAe-PN initiates a restart. In this moment the push-button has to be unhanded for firmware can start. |
| 6 | Firmware is running. |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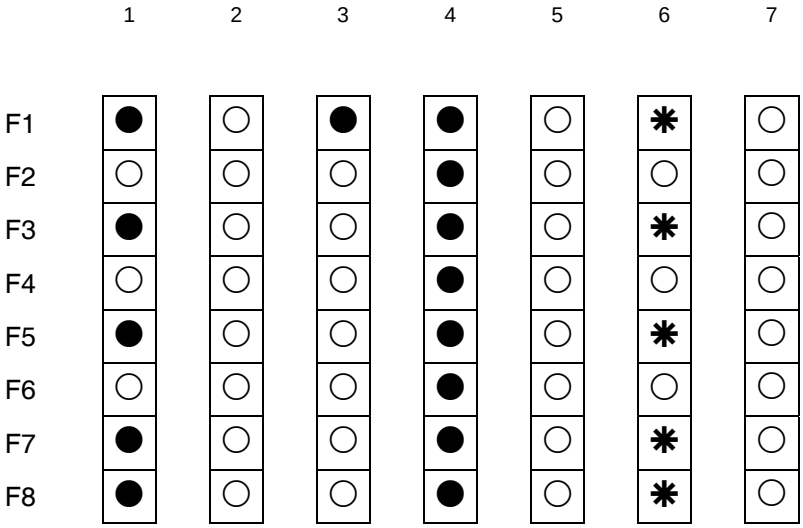
### 3.2.3 Restart

The following table shows how to initiate a restart. The image of the yellow LED F1 up to F8 is marked in each column.




| Column | Meaning |
|---|---|
| 1 | Firmware is running and no errors are existent.. |
| 2 | Push-button has been pushed and all LED switch-off. |
| 3 | Every second further LED switch-off. |
| 4 | After 8 seconds all LED are.switched-on. |
| 5 | After another second all LED switch-off. The push-button has to be unhanded now, and firmware receives information to initiate a restart. |
| 6 | Those LED, that flashed before pushing the push-button, flash one time for a short moment. |
| 7 | All LED switch-off. Restart will be initiated |



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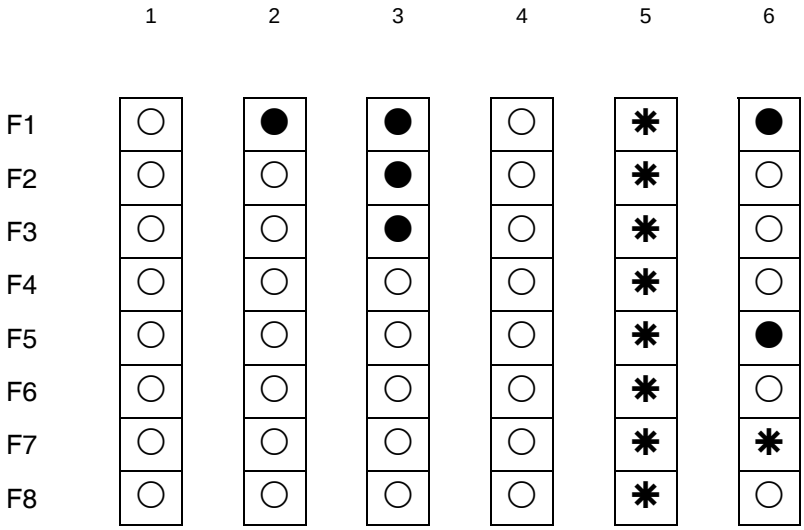
### 3.2.4 Factory-Reset

The Factory-Reset deletes the device unit name from the non-volatile memory of PAD-250MAe-PN.

The following description is based on the state of PAD-250MAe-PN without supply voltage.




| Column | Meaning |
|---|---|
| 1 | Push-button will be pushed, voltage returns and LED F1 up to F8 are switched-off. |
| 2 | The rack-LED switch-on, beginning with the PAD-LED (F1). |
| 3 | If the Setup-LED (F3) flashes, push-button will be unhanded. IP-address and device name will be deleted. |
| 4 | The PAD effects a restart. |
| 5 | All Rack-LED flash for a short moment. |
| 6 | The rack-LED display the active operating state of PAD-250MAe-PN. |



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# 4 Configuration and Operation

## 4.1 Hardware

The PROFINET IO-Device PAD-250MAe-PN will be inserted into the first slot of rack. When inserting into the rack the device unit has to engage properly. After engaging of device unit safety-screws have to be tightened. The device unit may only be inserted if the state of the PAD is without supply voltage.

## 4.2 DIP-Switch

The 8-pole DIP-switch influences firmware in the following manner:

**DIP-Switch**

| No | Status | Meaning |
|---|---|---|
| 1 | OFF | Expanded info-signals via serial interface |
| | ON | Normal operation |
| 2 | | Reserved |
| 3 | OFF | Data transfer only if expected rack configuration corresponds to found rack configuration. |
| | ON | Even though configured PADs are missing, data transfer will be started with available PADs. |
| 4..6 | | Reserved |
| 7,8 | | DAP-Selection |

Default-regulation of DIP-Switches: ON.



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**DIP-SW7/8 DAP-Selection**

| SW7 | SW8 | Meaning |
|---|---|---|
| OFF | ON | DAP-v2-RT |
| ON | OFF | DAP-v1-RT |
| OFF | OFF | DAP-Auto-Mode |
| ON | ON | |

In state of DAP-Auto-Mode PAD-250MAe-PN registers itself as DAP-v2-RT device unit when first connection will be established. Should be detected during first connection establishment that PROFINET IO-Controller does not support the RT-C2-communication-class, PAD-250MAe-PN reinitializes and registers itself as DAP-v1-RT device unit (only RT-C1-communication).

## 4.3 GSD-File

The included GSD-File describes all modules supported by PAD-250MAe-PN (see chapter 2.1.1), as well as the performance of PAD-250MAe-PN in network.

The GSD-File will be integrated into the configuration tool of PROFINET IO-Controller.

This file comprises 2 Device Access Points (DAP) for compatibility with different interface characteristics respectively firmware versions of the PROFINET IO-Controller:

- DAP v1 RT
  Corresponds to the GSDML-Specification 1.0 and is not designed for PROFINET IO-Controller, which do not support the interface- and port-concept of the GSDML-Specifications 2.2. This DAP enables the RT-C1-communication.
- DAP v2 RT
  Corresponds to the GSDML-Specification 2.2 and supports its interface- and port-concept. This DAP enables the synchronized and asynchronous RT-C2-communication.

Note: The communication-class will not be determined by means of the application but only via the PROFINET IO-Controller during the Network-Start-UP-Phase.

The name of the GSD-File is composed of the following components:

GSDML-V2.2-APEX-PAD250MAe-PN-yyyymmtt.xml’

yyyy indicates the year, mm the month and tt the day of generation.


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## 4.4 Device-Identification

PAD-250MAe-PN reports the following parameters in network:

| Name | Value |
|---|---|
| Station Name | ‘ ‘ will be generated during configuration |
| Station Type | PAD250PN |
| Manufacturer-ID | 0x01B0 (440dez) APEX automation technologies GmbH |
| Device-ID | 0x0010 |
| MAC-Address | 00:05:DA:xx:yy:xx |

## 4.5 PROFINET-Addressing

PAD-250MAe-PN will be addressed by PROFINET IO-Controller via device name.

The assignment of device unit name will be done by the configuration tool of the PROFINET IO-Controller. The IP-Address will be assigned by PROFINET IO-Controller. The device name will be backed-up non-volatile in PAD-250MAe-PN.

Delivery status of PAD-250MAe-PN is: No device name and no IP-Address (respectively 00:00:00:00:00:00). This status can be restored by:

- Factory-Reset with the push-button (see chapter 3.2.4).
- Configuration tool (see chapter 6.2.2)



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## 4.6 Diagnostics-Module

Status data of the respective PAB1-IO-cards will be gathered in the diagnostics-module and broadcasted togehter with the cyclic IO-data.

**Configuration Diagnostics-Module**

| Offset | Name | Meaning |
|---|---|---|
| 0 | DIAG_ERR_FLAGS | Error-bits of each single IO-card |
| 2 | DIAG_INFO | Reserved |
| 4 | DIAG_SLOT1 | Status information Slot 1 |
| 6 | DIAG_SLOT2 | Status information Slot 2 |
| …. | …. | …. |
| 20 | DIAG_SLOT9 | Status information Slot 9 |

**Configuration DIAG_ERR_FLAGS-WORD**

| BIT-Offset | Meaning |
|---|---|
| 0 | Error-bit PAB1-IO-card Slot 1 |
| 1 | Error-bit PAB1-IO-card Slot 2 |
| …. | .... |
| 8 | Error-bit PAB1-IO-card Slot 9 |
| 9…13 | Reserved (0) |
| 14 | Global error flag* |
| 15 | Reserved (always 1) |

*The global error flag' will be set, if an error bit of an IO-card is set or it is an existing configuration mismatch in slot. The value for error-free status is 0x8000 in DIAG_ERR_FLAGS.


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### Configuration DIAG_SLOTx-WORD

| BIT-OFFSET | Value | Meaning |
|---|---|---|
| 0 | 1 | Slot is configured |
| | 0 | Slot is not configured |
| 1 | 1 | Wrong card in configured slot |
| | 0 | - |
| 2 | 1 | No card in slot |
| | 0 | - |
| 3…14 | | Reserved (0) |
| 15 | 1 | Error-bit of PAB1-IO-card set |
| | 0 | Error-bit of PAB1-IO-card deleted |

### Bit0..2 in DIAG_SLOT-WORD

| B_2 | B_1 | B_0 | Meaning |
|---|---|---|---|
| 0 | 0 | 0 | Not configured slot with card |
| 1 | 0 | 0 | Not configured slot without card |
| 0 | 0 | 1 | Configured slot with right IO-card |
| 1 | 0 | 1 | Configured slot without IO-card |
| 0 | 1 | 1 | Wrong card in configured slot |



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## 4.7 Shutdown of outputs

For device protection the outputs are shut down (all digital outputs are set to ’0’, all analog output-register are set to 0x0000). Following causes initiate shutdown of outputs:

- PROFINET IO-Controller has entered ‚STOP’-state.
- Connection to PROFINET IO-Controller is broken.
- Undervoltage-detection is active.

After ‚Power-Up’ respectively ‚Reset’ of PAD-250MAe-PN all found outputs are shut down until configuration data of PROFINET IO-Controller are available.

## 4.8 Undervoltage-Detection at restart

After ‚Power-Up’ respectively reset and occured hardware initialization the PAD-250MAe-PN checks input voltage as long as valid voltage range has been reached (undervoltage-detection will no longer be activated).

During this timing (a few ms) the yellow PAD-LED (F1) and yellow Hardware-LED (F2) are flashing. The red rack-status LEDs M1r...M8r are flashing and signalize the error-code 255 (undervoltage).

After input voltage has entered the valid voltage range the PAB1-Bus will be scanned and found outputs will be shut down.


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## 4.9 Undervoltage-Detection during operation

If input voltage during operation drops in such a manner that undervoltage-detection is activated automatically, first action will be that all the outputs will be shut down for device protection.

Afterwards an undervoltage alarm signal will be sent to the PROFINET IO-Controller. 1,5 seconds later PAD-250MAe-PN initializes a restart.

Characteristics after restart are described in chapter 4.8.



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5 Update
5.1 Display of active firmware-version

# 5 Update

The PAD-250MAe-PN has to be in loader-mode for all consecutively described updates . Chapter 3.2.2.1 describes how to activate the loader in PAD-250MAe-PN.

Firmware as well as loader will be stored in separate ranges in the CPU flashmemory of the PAD-250MAe-PN. The device name will be stored in a separate flash memory.

Modifications of firmware or device name (eg. IP-Address) do not influence the other ranges.

Setup-data will be broadcasted to PAD-250MAe-PNduring restart of PROFINET IO-Controller.

## 5.1 Display of active firmware-version

Active firmware-version and HW-revision of the PAD-250MAe-PN are stored in the I&M0-data. These values can be read by the PROFINET IO-Controller and be displayed by a configuration tool. See also chapter 6.3.

After Power-Up a version message will be registered via the serial interface and can be recorded by the terminal programme. Following interface parameter are to be used:

- 115.200 Baud
- 8 data bits
- 1 stop bit
- no parity




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## 5.2 Firmware Update

The firmware update will be done via the USB-interface with an USB-Stick (FAT16/32) in whose main directory the firmware file app.mhx has to be located.

For loading a new firmware, the following steps are essential:

- Storing of the new firmware file in main directory of USB-Stick with file name „app.mhx“.
- To bring PAD-250MAe-PN to enter the loader-status by pushing of push-button (see chapter 3.2.2.1).
- To connect the USB-Stick with the firmware-files.
- After succesful download the PAD-250MAe-PN initializes a reset and starts the new firmware.

## 5.3 Display of active loader-version

After activation of loader its version number will be registered via the serial interface.

The loader activation is described in chapter 3.2.2.1.

The loader uses following protocol:

- 115.200 Baud
- 8 data bits
- 1 stop bit
- no parity



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# 6 Appendix

## 6.1 Error Codes

If a hardware-error is find out during the boot-phase of firmware, the yellow Hardware-LED (F2) will flash and the M1r..M8r-LED will display an error-code.

**Diagnostics Error-Code**

| Error-Code | Meaning |
|---|---|
| 1 | Error during I2C-Initialization |
| 2..4 | Eeprom-error |
| 5 | Error during PROFINET-Initialization |
| 255 | Powerfail. |

The error-code is the sum of priority rating of the single rack-LED. The priority rating of the LED is as follows:

| LED | M1r | M2r | M3r | M4r | M5r | M6r | M7r | M8r |
|---|---|---|---|---|---|---|---|---|
| Priority rating | 1 | 2 | 4 | 8 | 16 | 32 | 64 | 128 |


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## 6.2 Configuration with Step7

The description for configuration of PAD-250MAe-PN requires the following preconditions:

- The application of Step7, version V5.4 or higher.
- A PROFINET IO-Controller with configured PROFINET-Subnet.

The PAD-250MAe-PN will be integrated into the Step7 project in the following manner:

- The delivered GSD-file will be installed into the catalogue of the HW-configuration.
- PAD-250MAe-PN of the catalogue will be added to the PROFINET- Subnet.
- The rack of PAD-250MAe-PN will be provided with the corresponding modules.
- The device name of PAD-250MAe-PN will be assigned.



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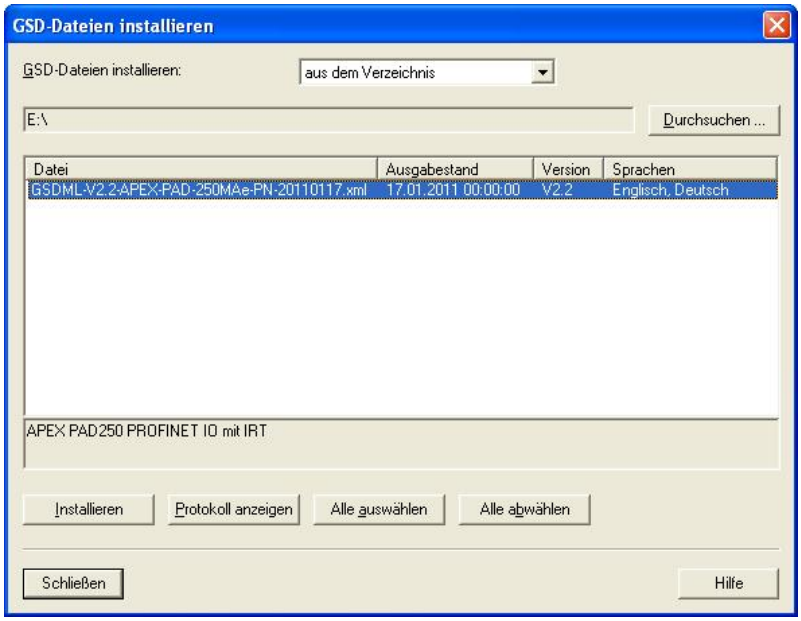
### 6.2.1 Installation of GSD-File

In order to be able to use PAD-250MAe-PN in Step7, PAD-250MAe-PN including all optional modules will be installed into the catalogue of the HW-configuration. The delivered GSD-File (see chapter 4.3) will be installed as follows:

- Start HW configuration.
- Open menu item „Extras ➔ GSD-Datei installieren“ .
- Select delivered GSD-File.
- Select menu item „Extras ➔ Katalog aktualisieren“.




After successful installation PAD-250MAe-PN is available in catalogue under „PROFINET IO ➔ Weitere Feldgeräte ➔ General“.

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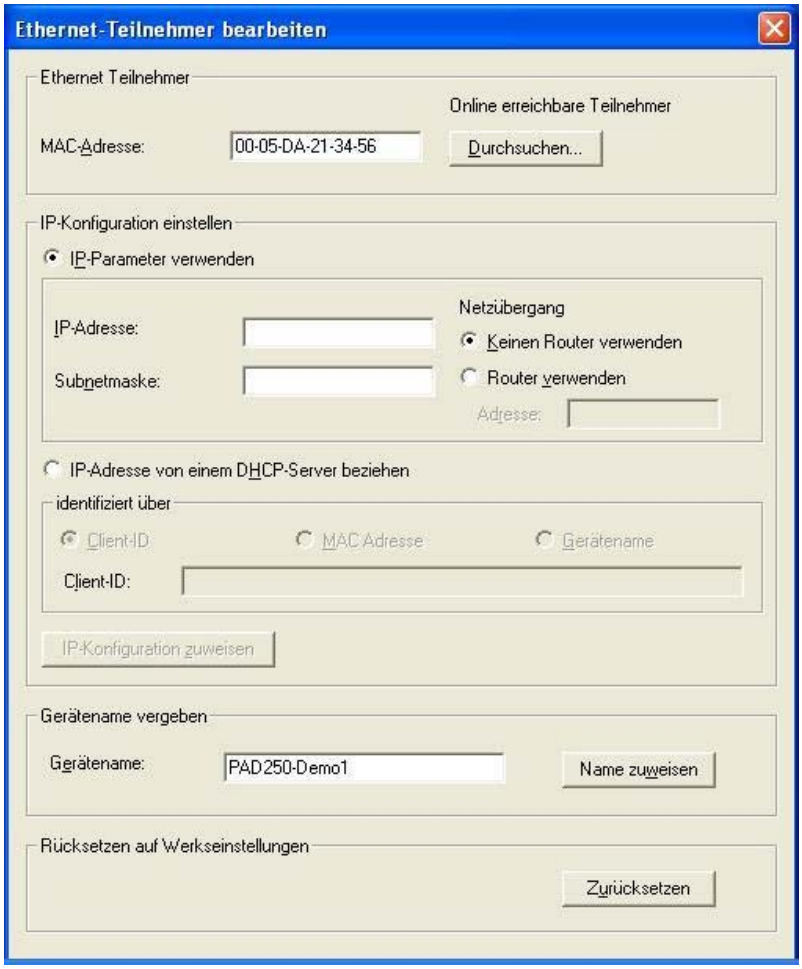
### 6.2.2 PROFINET-Addressing

Device name and IP-Address are responsible for addressing of PAD-250MAe-PN. The PROFINET IO-Controller assigns the IP-Address on basis of the configuration of PROFINET-Subnet.

The device name will be assigned in the Simatic-Manager:

- Select menu item „Zielsystem➔ Ethernet-Teilnehmer bearbeiten“.
- Select with „Durchsuchen“ the MAC-Address of PAD-250MAe-PN.
- Register device name and back-up with „Name zuweisen“ non-volatile in PAD-250MAe-PN.



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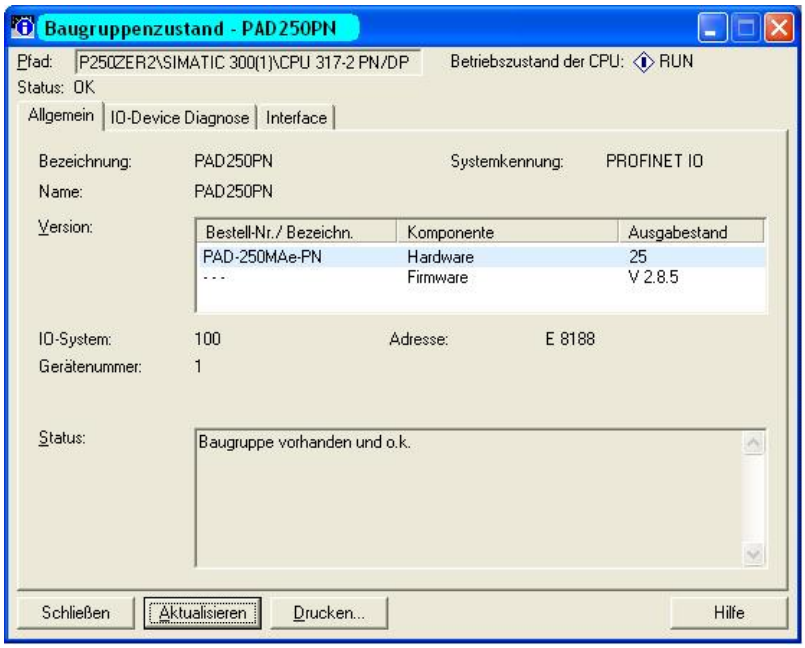
The above menu also offers the possibility to delete via „Zurücksetzen“ the IP-Address and device name. After reset to factory setting the PROFINET-Status LED (P3) displays error code 3.

## 6.3 Display of HW- and FW-Version

The hardware- and firmware-version numbers can be displayed by the Simatic-Manager under menu item „HW Konfig ➔ Zielsystem ➔ Baugruppenzustand“.







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## 6.4 Sequence Time

The sequence time for update of input and output data depends on implementation of the DTA-rack. The run-time for all global routines without the data transfer time is about ~ 3ms. The data transfer time to respectively of a digital IO-card is less than 0,1ms. The data transfer time to an analog output card is also less than 0,1ms. The data transfer time for all data of an analog input card is for example for the ADU 115 ~2ms (for the ADU 116 ~0,5ms). The sequence time is the sum of all data transfer times of configured cards and the 3ms run-time.

The data transfer time to an analog output card is the time needed to write the output data into the D/A converter's register. Until the output data actually appear at the output another time interval passes by which depends on the used converter on the analog IO-card. More detailed information to this topic are to be found in the respective documents of the analog IO-card.

The data transfer time of an analog input card is the time needed to make the measured values available in memory. The PAD-250MAe-PN has no influence on the update time of measured values in memory. This time will be determined only by the used analog input card and is to be read in the documentation of the IO-card. The actual measure time for one channel can definitely be about 20ms. Consequently, for 16 channels, an update time of 320ms can be expected.



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